Journal of the Kansas Entomological Society

Vol. 21 January, 1948 Number 1

PUBLICATION COMMITTEE

PAUL B. LAWSON, Editor, Lawrence
R. H. BEAMER, Lawrence R. H. PAINTER, Manhattan
DWIGHT ISELY, Fayetteville, Ark.

JAMES WALKER McCOLLOCH
1889-1929

Entered as second-class matter June 7, 1939 at the Post Office at Manhattan, Kansas, under the Act of August 24, 1912.

ENTOMOLOGICAL SOCIETY
JOURNAL OF THE KANSAS

A quarterly journal published in January, April, July and October devoted to Entomology in the Western Mississippi Basin and the proceedings of the Kansas Entomological Society.

Manuscripts for publication may be sent to any of the publication committee.

The Kansas Entomological Society does not make exchanges since the Society does not maintain a library.

Subscriptions to the Journal must be paid in advance. The subscription rate is so low that second notices are not ordinarily sent out.

Payment of Canadian or other foreign subscriptions and bills must be made by international Postal Money Order or by a draft on a New York bank and payable in U.S.A. dollars.

Subscribers are urged to give us their full cooperation in these matters.

Subscriptions should be sent to Donald A. Wilbur, Department of Entomology, Kansas State College, Manhattan, Kansas.

Subscriptions in the U.S.A.,	**$2.00 per year**	**Single Copy**
Canadian or foreign subscriptions,	**2.25 per year**	**75 cents**

KANSAS ENTOMOLOGICAL SOCIETY

President, Fred D. Butcher
Vice-President, Leon W. Hepner
Secretary-Treasurer, Donald A. Wilbur
Editor, P. B. Lawson

Vol. 21, No. 1, January, 1948
This issue mailed March 17

Ko
Vol.

S

Brach
Re
den b
on fa
S
slightl
carina
than b
cate,
segme
C
with a
above
latter
dark,
G
proces
gus ab
to ang
near b
in cau
triang
H
14, 194
10 ♀ ♀
same
Conn.,
P. W.
lingtor
seum.

Macro
Li
length

*Co

Kansas Entomological Society
Vol. 21 January, 1948 Number 1

SOME NEW SPECIES OF DELPHACODES (Continued)

(Homoptera, Fulgoridae, Delphacinae)

Part III

R. H. BEAMER*
Lawrence, Kansas

21. **Delphacodes trimaculata** n. sp.

Brachypterous Form:

Resembling **Delphacodes waldeni** (Metc.) but smaller, color shiny golden brown with a black spot on base of scutellum, above middle coxae and on face. Length ♂ 2.0 mm.; ♀, 2.4 mm.

Structure: Front about one third longer than wide, widest near middle, slightly narrowed toward apex, more so toward base, tricarinate, middle carina blunt; crown almost without carinae, longer than wide, wider at apex than base, apex broadly rounded; elytra almost as wide as long, apices truncate, veins slightly heavier, not very definite, extending to third abdominal segment; hind wings small pads, scarcely one third as large as an eye.

Color: General color shining fulvous; abdomen darker than thorax, often with a still darker broad, longitudinal stripe on either margin, a large spot above middle coxae, another in base of scutellum and genae black, this latter in females often involves whole front; venter of female more or less dark, male genital capsule black.

Genitalia: In lateral view pygofer very narrow; anal segment without processes but antero-ventral corners enlarged to form aedeagal guide; aedeagus about twice as long as greatest width which is at end of basal third due to angular bulge, apex rounded; styles widest at base, greatly narrowed near basal third, enlarged on outer third and narrowed to slender apices; in caudal view styles widest at base, narrowed to outer third, widened to triangular apices; practically no aedeagal brace.

Holotype ♂, allotype ♀, 39 ♂ and 38 ♀ paratypes, Storrs, Conn., Aug. 14, 1946, R. H. Beamer; other paratypes: same place and collector, 13 ♂ ♂ and 10 ♀ ♀, Aug. 3, 1946; same place and collector, 4 ♂ ♂ and 1 ♀, Aug. 4, 1946; same place and collector, 1 ♂, Aug. 10, 1946; 2 ♂ ♂ and 1 ♀, Willimantic, Conn., Aug. 5, 1946, R. H. Beamer; 1 ♀, 3 ♂ ♂, Ashton, Md., Aug. 27, 1938, P. W. Oman; 6 ♀ ♀, Washington, D. C., Sept. 22, 1934, P. W. Oman; 1 ♂, Arlington, Va., July 30, 1938, P. W. Oman. Paratypes in the U. S. National Museum.

Macropterous Form:

Like the brachypterous form except wings extending one third their length beyond abdomen whitish-semihyaline with darker veins; color

*Contribution from the Department of Entomology, University of Kansas.

black except legs, clypellus, dorsum of thorax and pronotum back of each eye to base of wings stramineous.

Holomorphotype ♂, allomorphotype ♀, 3 ♂ and 16 ♀ paramorphotypes, Storrs, Conn., Aug. 14, 1946, R. H. Beamer; other paramorphotypes; same place and collector, 4 ♂ ♂ and 3 ♀ ♀, Aug 3, 1946; same place and collector, 1 ♂, Aug. 4, 1946; same place and collector, 1 ♀, Aug. 10, 1946; 1 pair, Willimantic, Conn., Aug. 5, 1946, R. H. Beamer.

Types in Snow Entomological Collections.

22. Delphacodes penepuella n. sp.

Brachypterous Form:

Resembling **Delphacodes** peulla (V. D.) but dark spot at apex of clavus continued diagonally forward across elytra, crown narrower and longer and aedeagus bent ventrally instead of dorsally with only five teeth near middle. Length ♂ 1.5 mm.; ♀, 1.8 mm.

Structure: Front about twice as long as wide, definitely constricted at base, very slightly so at apex, in between almost parallel-sided, strongly tricarinate; crown more than one third longer than basal width, widest at apex, strongly carinate; elytra widest near middle, apices broadly rounded, reaching almost to genital capsule in ♂ to fourth abdominal segment in ♀; hind wings reduced to less than one fourth size of eye.

Color: General color dark with legs, carinae of front, anterior half of crown, hind border of pronotum, apex of scutellum, base of abdomen, some spots on lateral margin of abdomen, the posterior margin of some abdominal segments and elytra, except the rather broad diagonal cross band from tip of clavus forward, stramineous to cinereous.

Genitalia: In lateral view pygofer about one third deeper than long; anal segment with a pair of processes arising near middle, often distorted as to shape and origin; aedeagus widest at base, gradually tapered to dorsally turned tip, bent ventrally at less than a right angle near basal third; styles widest at base, more or less pediform on outer two thirds; in caudal view widest at base, very slightly narrowed and curved laterally, then medianly with apex right-angled on inner margin and slightly rounded and bulged on outer margin.

Holotype ♂, allotype ♀, 34 ♂ and 56 ♀ paratypes, Otter Lake, N. Y., July 25, 1946, R. H. Beamer; 2 ♂ ♂, Hilliard, Fla., Oct. 5, 1938, P. W. Oman; ♂ South of Picnic, Fla., Nov. 8, 1938, P. W. Oman. Paratypes in the U. S. National Museum.

Macropterous Form:

Like brachypterous except elytra and flight wings extending about one third their length beyond abdomen and dark spot at tip of clavus not extending diagonally foreward across elytra.

Holomorphotype ♂, Hilliard, Fla., Aug. 31, 1930, R. H. Beamer.

Types in Snow Entomological Collections.

23. Delphacodes recurvata n. sp.

Brachypterous Form:

Resembling **Delphacodes waldeni** (Metc.) but smaller, generally lighter in color and male with a pair of recurved processes on anal segment. Length ♂ 2.3 mm.; ♀ 2.6 mm.

Structure: Front about twice as long as wide, widest at middle, narrowed toward each end, more so toward base, about half as wide at base as middle, strongly tricarinate; crown about twice as long as wide, carinae definite; elytra barely longer than wide, apices truncate, extending on to second abdominal segment, hyaline, veins heavier; hind wings not evident.

Color: Stramineous to brownish with a small darker spot in apices of elytra, semblance of darker longitundinal lines on dorsum of abdomen, aedeagus and styles brown.

Genitalia: In lateral view anal segment with a pair of long slender processes arising on antero-ventral corner of anal segment and recurved to extend parallel with ventral margin; aedeagus widest at base, contracted near basal third to half basal width, slightly curved ventrally with three fairly large teeth on dorsal margin near outer third, aedeagal brace evident; styles swollen near middle on inner margin with flange on outer margin at apical third. In caudal view styles arcuate, widest at middle with curving flange on apical third of inner margin.

Holotype ♂, allotype ♀, Hilliard, Fla., July 28, 1934, R. H. Beamer; paratypes: 1 ♂ same place and date, M. E. Griffith; 1 ♂, Punta Gorda, Fla., Mar. 12, 1947, R. H. Beamer; 18 ♂ ♂ and 7 ♀ ♀, Sanford, Fla., Mar. 11, 1947, R. H. Beamer; 1 ♂, Sanford, Fla., May 7, 1926, E. D. Ball; 1 ♂, Sanford, Fla., June 4, 1926, E. D. Ball; 1 ♂, Sanford, Fla., Oct. 29, 1926, E. D. Ball; 1 ♀, Sanford, Fla., Dec. 11, 1926, E. D. Ball; 1 ♀, Sanford, Fla., May 13, 1926, E. D. Ball; 1 ♀, Coco Fla., May 5, 1926, E. D. Ball; 3 ♀ ♀, Gainesville, Fla., Nov. 5, 1927; 1 ♂ and 2 ♀ ♀, Washington, D. C., Oct. 26, 1941, P. W. Oman. Paratypes in the U. S. National Museum.

Macropterous Form:

Like the brachypterous form but with both pairs of wings about one third longer than abdomen; elytra milky semihyaline with veins brown, especially so on outer half.

Holomorphotype ♂, Coconut Grove, Fla., Paul W. Oman.

Types in Snow Entomological Collections.

24. Delphacodes incurva n. sp.

Brachypterous Form:

Resembling **Delphacodes nigriscutellata** Bmr. but much smaller, elytra with apices rounded, base of crown usually light in color and processes of anal segment with apices sharply bent in. Length of ♂ 1.8 mm.; ♀ 2.0 mm.

Structure: Front not quite twice as long as wide, widest near middle, narrowed toward each end, very slightly more so toward base, almost without carinae, median carina more or less distinct in female; crown barely

longer than wide, narrowest near middle, apex broadly rounded, carinae becoming more distinct on basal half; elytra extending on to third abdominal segment, slightly longer than broad with apices broadly rounded, veins heavier; in female apices slightly less rounded.

Color: General color stramineous. Male with cloudy spot above hind coxae, large spot above middle coxae, face below eye and in front of antennae, front, anterior half of crown, scutellum, dorsum of abdomen, except large basal area, most of last segment and dorsum of genital capsule, dark brown to black; female entirely light colored.

Genitalia: In lateral view anal segment with a pair of broad processes with sharp apices turned in at right angles; aedeagus widest at base, slightly more than twice as long as basal width, gradually narrowed and slightly S-shaped with three large teeth on ventral margin just beyond middle and three to four lateral teeth near apex, styles short, narrowed at middle, enlarged at apices and slightly bifid. Styles in caudal view distinctly avicephaliform with small, sharp beak on inner margin and large rounded head on outer.

Holotype ♂, allotype ♀, 21 ♂ and 12 ♀ paratypes, Storrs, Conn., Aug. 15, 1946, R. H. Beamer; 1 ♂ paratype, Liberal, Kansas, Aug. 16, 1945, R. H. Beamer. Types in Snow Entomological Collections.

25. **Delphacodes latidens** n. sp.

Brachypterous Form:

Resembles **Delphacodes incurva** Bmr. but much larger, elytra much longer, in male extending to tip of abdomen, processes of anal segment of male with apices not bent in at right angle and styles in lateral view quite slender on outer third. Length ♂ 2.0 mm.; ♀ 2.5 mm.

Structure: Front slightly less than twice as long as wide, widest near middle, tapered toward each end, more so toward base, definitely tricarinate on outer half; crown longer than wide, apex broadly rounded, wider than base, carinae evident at base; elytra in male reaching to tip of abdomen, in female to third from last abdominal segment, apices broadly rounded, veins raised.

Color. General color stramineous; in male spot above middle coxae, genae beneath eye and in front of antennae, front except narrow apical band and scutellum, shiny black, spot above hind coxae fumose, dorsum of abdomen orange with more or less darker markings; in female a spot above middle coxae, one beneath ocellus and a row of spots on dorso-lateral margins of abdomen black, a small fumose spot above hind coxae, front light brown instead of black as in male; elytra semihyaline.

Genitalia: In lateral view anal segment with a pair of heavy, broad processes; aedeagus widest at base, more or less sinuate and narrowed to blunt apex, a few short teeth on each margin before tip; aedeagal brace of medium size; styles parallel-margined on basal two thirds, rapidly narrowed on outer margin on outer third. In caudal view styles widest at base, narrowing to avicephaliform apices with sharp beak on inner margin.

Holotype ♂, allotype ♀, 2 ♂ and 6 ♀ paratypes, Sarita, Texas, Dec. 25, 1945. Other paratypes: 1 pair, Mission, Texas, Dec. 25, 1945, R. H. Beamer; 1 ♂, San Antonio, Texas, June 25, 1938, R. H. Beamer; 1 ♂, Sheffield, Texas, July 10, 1938, R. H. Beamer; 1 ♂, Val Verde Co., Texas, June 28, 1940, D. J. and J. N. Knull, in Ohio State Collection.

Types and paratypes in Snow Entomological Collections.

26. **Delphacodes lutulentoides** n. sp.

Brachypterous Form:

Resembling **Delphacodes lutulenta** (Van D.) but usually lighter in color, carinae of front and crown definitely stronger, styles much more spatulate in both lateral and caudel view and aedeagus with several teeth on sides. **Length** ♂ 2.0 mm.; ♀ 2.8 mm.

Structure: Front almost two thirds as wide as long, widest near middle, converging toward each end, slightly narrower at apex, strongly tricarinate; crown longer than wide, strongly carinate at least at base; elytra short, barely longer than wide, apices broadly rounded, reaching to about middle of abdomen; hind wings reduced to pads about one third size of eye.

Color: General color stramineous; in male more or less black between carinae of front and abdomen orange to black.

Genitalia: In lateral view pygofer quite narrow, hind margin excavated; anal segment without processes; aedeagus widest at base, about half as wide as total length, suddenly narrowed on ventral margin just before middle to less than half basal width, gently curved ventrally throughout; aedeagal brace large; styles, widest at base, narrowed in middle to about half basal width, apices spatulate. In caudal view styles widest at base, narrowed at middle on inner margin, apices slightly avicephaliform.

Holotype ♂, allotype ♀ and 7 ♂ paratypes, Tioga Pass, Calif., July 31, 1940, R. H. Beamer.

Types in Snow Entomological Collections.

27. **Delphacodes stramineosa** n. sp.

Brachypterous Form:

Resembling **Delphacodes hyalina** Bmr. but larger, without black between frontal carina, genital capsule light, aedeagus bent ventrally with rosette of spines at apex and with a pair of peculiar processes, one on each side of aedeagus at base. **Length** ♂ 2.4 mm.; ♀ 3.2 mm.

Structure: Front twice as long as wide, widest near middle, barely narrowed toward each end, base slightly wider than apex, tricarinate, median carina quite broad; crown almost square, slightly longer than wide, carinae definite but blunt; elytra extending to slightly beyond middle of abdomen, apices broadly rounded, veins raised, often sparsely set with dark setae; hind wings absent.

Color: General color stramineous, male with large anal processes black, female with a black triangular plate at base of ovipositor.

Genitalia: In lateral view pygofer slightly wider than long with a rounded protruding lobe on caudo-ventral corner; anal segment with a pair of very

large, curving, sharp processes; aedeagus, with sides almost parallel, about five times as long as wide, slightly curved ventrally throughout, with a rosette of spines at apex and at base a pair of slender, caudally-curving processes almost as long as aedeagus; aedeagal brace quite large; styles short, widest at base, almost straight, narrowed to knobbed apex. In caudal view styles about as in lateral except appearing longer; aedeagal brace broad with U-shaped median notch.

Holotype ♂, allotype ♀, 22 ♂ and 53 ♀ paratypes, Storrs, Conn., Aug. 4, 1946, R. H. Beamer; other paratypes; 15 ♂ ♂ and 30 ♀ ♀, same place and collector, Aug. 3, 1946; 8 ♂ ♂ and 16 ♀ ♀, same place and collector, Aug. 15, 1946; 1 ♂ and 10 ♀ ♀, Water Mill, Long Island, N.Y., Aug. 18, 1496, R. H. Beamer.

Types in Snow Entomological Collections.

28. **Delphacodes serrata** n. sp.

Brachypterous Form:

Resembling **Delphacodes alexanderi** (Metc.) but elytra not reaching beyond middle of abdomen, crown much longer than wide, female with black between lateral carinae only at union of front and crown and aedeagus bent dorsally with dorsal edge serrate. Length ♂ 2.2 mm.; ♀ 2.7 mm.

Structure: Front slightly more than twice as long as wide, widest on basal third, narrowed very gently throughout most of its length, then rather suddenly at apex and base, more so at base; crown about twice as long as wide, carinate, raised above level of eyes more than normal; elytra not reaching more than to middle of abdomen, veins raised, apices semitruncate; hind wings triangular pads, less than half as large as an eye.

Color: General color stramineous, male with dark spot above hind coxae, vittae between carinae of front black, elytra and abdomen black except large basal spot and some small lateral spots on dorsum of abdomen lighter; female varies from stramineous to buff, two short black stripes arising near base of front between carinae and ending near middle of crown, tips of tarsi and ovipositor darker, elytra almost hyaline.

Genitalia: In lateral view pygofer more or less rectangular, ventral margin about one fourth longer than dorsal; anal segment with a pair of

---

PLATE V

21. Lateral view of genital capsule of male of **Delphacodes trimaculata** Beamer.
21a. Caudal view of styles and aedeagal brace of **Delphacodes trimaculata** Beamer.
21b Lateral view of aedeagus enlarged of **Delphacodes trimaculata** Beamer.
22. Lateral view of genital capsule of male of **Delphacodes penepuella** Beamer.
22a. Caudal view of styles and aedeagal brace of **Delphacodes penepuella** Beamer.
22b. Lateral view of aedeagus enlarged of **Delphacodes penepuella** Beamer.
23. Lateral view of genital capsule of male of **Delphacodes recurvata** Beamer.
23a. Caudal view of styles and aedeagal brace of **Delphacodes recurvata** Beamer.
23b. Lateral view of aedeagus enlarged of **Delphacodes recurvata** Beamer.
24. Lateral view of genital capsule of male of **Delphacodes incurva** Beamer.
24a. Caudal view of styles and aedeagal brace of **Delphacodes incurva** Beamer.
24b. Lateral view of aedeagus enlarged of **Delphacodes incurva** Beamer.
24c. Lateral view of inner margin of one of anal spines of **Delphacodes incurva** Beamer.
25. Lateral view of genital capsule of male of **Delphacodes latidens** Beamer.
25a. Caudal view of styles and aedeagal brace of **Delphacodes latidens** Beamer.
25b. Lateral view of aedeagus enlarged of **Delphacodes latidens** Beamer.

D trimaculata

21b

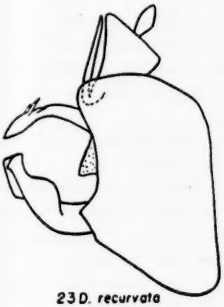
21a

22 D. penepuella

22a

22b

23b



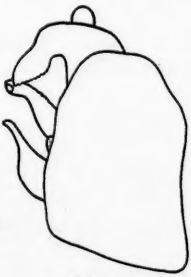
23 D. recurvata

23a

24 D. incurva

24b

25a



25 D. latidens

24a

25b

24c

rather straight sharp processes about as long as segment; aedeagus widest at base, evenly narrowed throughout and curved dorsally with apical third slightly turned caudally, dorsal margin serrate; styles almost hidden from view in the deep pygofer. In caudal view styles of normal length, widest at base, margins sinuous and narrowing to sharp apices; aedeagal brace in form of a narrow rectangular lobe at middle of broadly rounded opening.

Holotype ♂, allotype ♀, 23 ♂ and 21 ♀ paratypes, Storrs, Conn., Aug. 2-4, 1946, R. H. Beamer; 1 pair paratypes, South Dayton, N. Y., July 23, 1946, R. H. Beamer.

Types in Snow Entomological Collections.

29. **Delphacodes opaca** n. sp.

Brachypterous Form:

Resembling **Delphacodes atrata** Osb. but much smaller, darker in color, elytra not extending beyond middle of abdomen and aedeagus of male bifid for half its length. Length ♂ 1.4 mm.; 1.7 mm.

Structure: Front less than twice as long as wide, widest beyond middle, sides evenly curved toward each end, strongly tricarinate; crown almost as long as wide, front wider than base, carina present, stronger on basal half; elytra about as wide as long, reaching about to middle of abdomen, apices semitruncate, veins raised.

Color: General color dark brown to black throughout, region of hind coxae and caudal excavation of male genital capsule lighter.

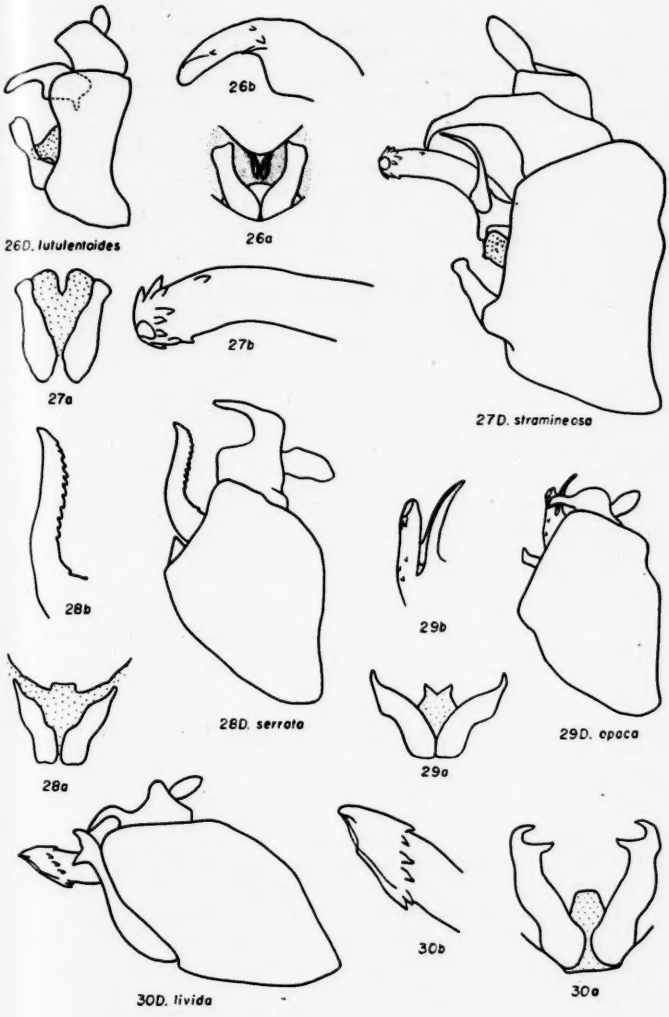
Genitalia: In lateral view pygofer more or less rectangular with ventral margin almost twice as long as dorsal; anal segment with a pair of sinuate processes about as long as segment; aedeagus widest at base, more than half as wide as long, curved dorsally, bifid for more than half its length, ventral portion with two teeth near tip and three smaller ones near base; styles barely visible in this view. In caudal view pygofer margin flared, deeply excavated; styles widest near base, sinuate with margins parallel to outer third where they narrow rapidly to sharp apices; aedeagal brace heavy with angular bifid apex.

Holotype ♂, allotype ♀, 7 ♂ and 4 ♀ paratypes, Willimantic, Conn., Aug. 8, 1946, R. H. Beamer; other paratypes, 14 ♂ ♂ and 8 ♀ ♀, Storrs, Conn.,

---

PLATE VI

26. Lateral view of genital capsule of male of **Delphacodes lutulentoides** Beamer.
26a. Caudal view of styles and aedeagal brace of **Delphacodes lutulentoides** Beamer.
26b. Lateral view of aedeagus enlarged of **Delphacodes lutulentoides** Beamer.
27. Lateral view of genital capsule of male of **Delphacodes stramineosa** Beamer.
27a. Caudal view of styles and aedeagal brace of **Delphacodes stramineosa** Beamer.
27b. Lateral view of aedeagus enlarged of **Delphacodes stramineosa** Beamer.
28. Lateral view of genital capsule of male of **Delphacodes serrata** Beamer.
28a. Caudal view of styles and aedeagal brace of **Delphacodes serrata** Beamer.
28b. Lateral view of aedeagus enlarged of **Delphacodes serrata** Beamer.
29. Lateral view of genital capsule of male of **Delphacodes opaca** Beamer.
29a. Caudal view of styles and aedeagal brace of **Delphacodes opaca** Beamer.
29b. Lateral view of aedeagus enlarged of **Delphacodes** opaca Beamer.
30. Lateral view of genital capsule of male of **Delphacodes livida** Beamer.
30a Caudal view of styles and aedeagal brace of **Delphacodes livida** Beamer.
30b. Lateral view of tip of aedeagus enlarged of **Delphacodes livida** Beamer.


26D. lutulentoides
26b
26a
27a
27b
27D. stramineosa
28b
28D. serrata
29b
29D. opaca
28a
29a
30D. livida
30b
30a

Aug. 3-15, 1946, R. H. Beamer; 6 ♂♂ and 5♀♀, Dingman's Ferry, Pa., Aug. 20, 1946, R. H. Beamer; 1 ♂, Mt. Lake, Va., Sept. 2, 1946, R. H. Beamer.

Types in Snow Entomological Collections.

30. **Delphacodes livida** n. sp.

Brachypterous Form:

Resembles **Delphacodes acuministyla** Dozier but distinctly larger, black in color and male styles in caudal view with bifid, more or less U-shaped apices. Length ♂ 2.0 mm. ♀ 2.2 mm.

Structure: Front almost twice as long as wide; widest near apical third, gently narrowed toward each end, apex wider than base, tricarinate; crown definitely longer than wide, carinate with those on anterior half indistinct; elytra reaching slightly beyond middle of abdomen, apices broadly rounded in female, slightly more truncate in male, hind wings triangular pads about one third as large as eye.

Color: General color light brown to black; legs, front in some specimens, crown and antennae light brown, elytra, most of abdomen and genital capsule shining black, anal tube, small portion of dorsum of last abdominal segment light.

Genitalia: In lateral view pygofer more or less trapezoidal; anal segment with a pair of curved, sharp processes arising on outer lower corner; aedeagus widest near outer third, shaft almost straight, with a diagonal circle of teeth at widened spot; styles widest at base, narrowing to bifid apices. In caudal view styles widest at base, outer margin sinuate, apices bifid, U-shaped; aedeagal brace fair sized with apex blunt or slightly excavated.

Holotype ♂, allotype ♀; 27 ♂ and 1 ♀ paratypes, Storrs, Conn., Aug. 5-15, 1469, R. H. Beamer.

Types in Snow Entomological Collections.

NOTES ON THE BEET LEAFHOPPER, Circulifer tenellus (Baker),[1] AND ITS RELATIVES (Homoptera: Cicadellidae)

P. W. OMAN

Bureau of Entomology and Plant Quarantine
Agricultural Research Administration
U. S. Department of Agriculture

It is the purpose of the present paper to define the genus **Circulifer** Zakhvatkin and to discuss briefly the Old World distribution of **tenellus** and its other components. Notes on the identity of some of the species of **Circulifer** are given, but it is not possible at this time, with the limited material available, to undertake a critical study of the genus. There is included a "check list" of trivial names assigned to **Circulifer.**

It has long been recognized that **tenellus** was not properly placed in the genus **Eutettix**, that generic name being applicable only to a group of rather robust, oak feeding species from which **tenellus** differs very markedly in a number of characters. The apparent absence, from the Nearctic region, of species closely related to **tenellus** led naturally to the examination of avail-

[1] Commonly referred to in North American literature as **Eutettix tenellus** (Baker).

able material from other faunal regions in an attempt to resolve the correct generic position of the beet leafhopper. As a result of those studies it became evident that **tenellus** should be associated with a number of southern European species, for which Zakhvatkin in 1935 proposed the name **Circulifer**. Although the designation **"Eutettix tenellus"** has been continued in North America for more than ten years as a matter of convenience until certain problems of distribution could be clarified, it now seems desirable to adopt the generic designation which will emphasize the Old World distribution and relationships of **tenellus**.

THE GENUS CIRCULIFER ZAKHVATKIN

Circulifer Zakhvatkin, Wiss. Ber. Moskauer Staats Univ. 4:111, 1935. Type, by original designation, **Jassus haematoceps** Mulsant and Rey, 1855.

Distomotettix Ribaut, Soc. Hist. Nat. Toulouse Bul. 72: 97, 1938. Type, by original designation, **Jassus fenestratus** Herrich-Schaeffer, 1834.

Small leafhoppers, total length 2.75-4.00 mm. Head slightly wider than pronotum, anterior margin rounded, crown short and convex. Clypellus slender, constricted basad of middle. Lateral margins of genae sinuated below eyes. Ocelli near eyes. Lateral margins of pronotum short. Forewing with appendix well developed; apical cells short; outer anteapical cell small, usually elongate-ovate in shape; central anteapical cell constricted; inner anteapical cell open basally. Hind wing with four apical cells. Aedeagus symmetrical and having two orifices; ejaculatory duct bifurcate. Pygofer of male with a dorsally directed, sharp, spine-like process.

The typical members of the genus, of which **tenellus** is one, have the following features supplementary to the characters given above. Distal processes of the aedeagus forming a complete or nearly complete circle, posterior margin of sternite VII of female sinuated and with a brown-bordered median emargination. In contrast to the typical forms, **C. fenestratus**, type of **Distomotettix**, has the distal processes of the aedeagus shorter, forming but a semicircle, and the posterior margin of sternite VII of the female without a median emargination. Further study may indicate the desirability of retaining **Distomotettix** as a subgenus, especially if other species are found to have the same type of genital structures.

The Old World distribution of typical members of the genus **Circulifer** may be given as follows: the countries of southern Europe adjacent to the Mediterranean, the Balkan states, northern Africa, Yemen, Palestine, northern Arabia, the area around the Caspian Sea, the Punjab district of north India, and the deserts and arid regions of Asia from the Persian Gulf to the northeast as far as the steppe of Balagansk in south central Siberia. It is of interest to note that the distribution outlined involves an area that is ecologically very similar to that occupied by the beet leafhopper in North America. It is not clear from published records whether or not members of the genus occur to the east of the Tian-Shan range in Chinese Turkestan. **Circulifer fenestratus** (H-S.), in addition to occupying a considerable portion of the range outlined above, occurs much farther north in Europe than do the typical members of the genus, and is known from Germany, central Russia, and Finland.

CIRCULIFER TENELLUS (Baker)

Thamnotettix tenellus Baker, Psyche 7 (suppl.): 24, 1896.
Thamnotettix rubicundula Van Duzee, Buffalo Soc. Nat. Sci. Bul. 8 (5): 70, 1907.
Thamnotettix ignavus Matsumura, Jour. College Sci., Imp. Univ. Tokyo 23: 22, 1908. (New synonymy, new combination).
Thamnotettiv indivisus Haupt, Palestine Agric. Exp. Sta. Bul. 8: 35, 1927.

At the time I suppressed **indivisus** as a synonym of **tenellus**[2] there existed some slight doubt as to the source of Haupt's material. There no longer seems reason to doubt that Haupt's specimens came from Palestine, and in the absence of evidence to indicate the specific distinctness of **indivisus** I retain that name in synonymy, although Ribaut[3] lists it as distinct. Recently I have been able to study a specimen of **ignavus** Matsumura,[4] described from Sicily. This specimen, presumably a syntype, is a typical example of **tenellus**. This record establishes beyond question the fact that **tenellus** occurs in the Mediterranean area. It seems probable that other records of forms from the Old World also apply to **tenellus**. On the basis of the description given, **salus** (Matsumura) described from Sicily, may be **tenellus**. The characters of sternite VII of the females, as illustrated by Zakhvatkin for the Yemenian specimens described as **chinai, arabicus,** and **jenjouriste,** come within the observed range of variation of that structure in **tenellus**. Zakhvatkin gives no characters for these species that will differentiate them from **tenellus** and does not describe the male sex.

The accompanying illustrations (fig. 1) of the inner male genital structures and sternite VII of the female of **tenellus** will serve well to depict the general nature of those parts in typical members of the genus. The distal processes of the aedeagus do not lie in the same plane as the shaft of the aedeagus, and when viewed at right angles to the plane in which they lie they form an almost perfect circle. The shape of the male plates appears to be relatively constant within a species and hence useful in specific differentiation. The shape of sternite VII of the female is subject to considerable variation with respect to the degree of sinuation of the posterior margin and the depth and shape of the median emergination, but this structure may also be useful in distinguishing between related species once the extent of variation is determined.

Circulifer nausharensis (Pruthi), new combination

Through the courtesy of Dr. B. N. Chopra, Director, Zoological Survey of India, I was able to examine two female specimens of **nausharensis,** described from material collected in the Punjab district of north India. These specimens are typical of the genus **Circulifer** and differ from **tenellus** in having the median emargination of sternite VII shallow and subquadrate. The male plates, as described and figured by Pruthi, are triangular in outline, similar to those of **vittiventris (Lethierry).**

---

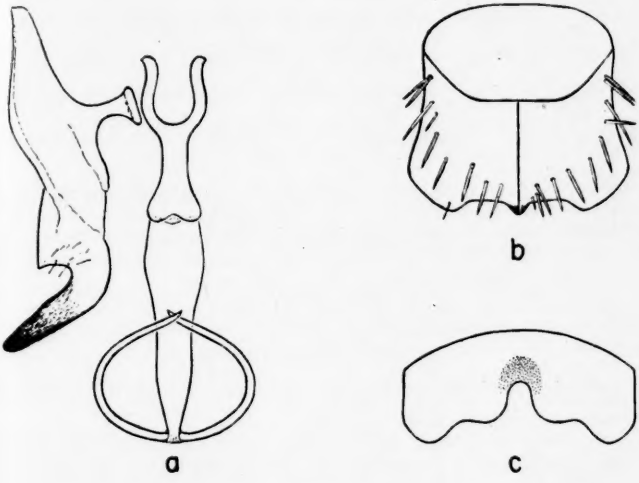
[2]Ent. Soc. Washington Pros. 38 (7): 164-165, 1936.
[3]Soc. Hist. Nat. Toulouse Bul. 77: 12, 1942.
[4]I wish to express my sincere appreciation to Major J. E. Webb, Jr., whose assistance made the study of specimens from the Matsumura collection possible. I also thank Dr. Toichi Uchida and Dr. T. Inukai, of the Hokkaido Imperial University, Japan, for their cooperation in arranging the loan of this material.

Circulifer dubiosus (Matsumura)

Four specimens, presumably syntypes of this species which was described from Sicily and Tangier, Spanish Morocco, were sent to me from the Matsumura collection by Major Webb. **C. dubiosus** is closely related to **tenellus** but differs in being slightly more robust, having the median emargination of sternite VII of the female deeper, the male plates larger and subtruncate, and the terminal portion of the male styles stouter.

The following check list of representatives of the genus **Circulifer** has been compiled for the most part from literature. I have omitted **Cicadula flaveola** Matsumura, 1908, since there exists some doubt that it is a **Circulifer** although tentatively assigned to the genus by Zakhvatkin.[5] It is probable that still other described species will be placed in this genus when the fauna of western Asia is better known.

Ribaut[6] apparently considers **alboguttatus** (Lethierry), **guttulatus** (Kirschbaum), and **indivisus** (Haupt) as valid species. In my discussion of **tenellus** I have indicated my reason for retaining **indivisus** as a synonym of that species. On the basis of the scanty material studied, I consider **alboguttatus** and **guttulatus** but variants of **fenestratus**, a conclusion in agreement with the past treatment of these forms by European workers.



EXPLANATION OF FIGURE 1

Details of **Circulifer tenellus** (Baker): a, style, connective, and aedeagus, ventral view; b, male plates; and c, sternite VII of female.

[5]Wiss. Ber. Moskauer Staats Univ. 4:111, 1935.

[6]Soc. Hist. Nat. Toulouse Bul. 77: 12, 1942.

CHECK LIST OF TRIVIAL NAMES ASSIGNED TO THE GENUS CIRCULIFER

alboguttatus (Lethierry) = fenestratus (Herrich-Schaeffer)

arabicus Zakhvatkin

Circulifer arabicus Zakhvatkin, Royal Ent. Soc. London Trans. 96: 161, 1946.

caspius Zakhvatkin=chinai Zakhvatkin

chinai Zakhvatkin

Circulifer chinai Zakhvatkin, Royal Ent. Soc. London Trans. 96; 160, 1946.

Circulifer chinai subsp. **caspius** Zakhvatkin, Royal Ent. Soc. London Trans. 96: 160, 1946.

dubiosus (Matsumura)

Thamnotettix dubiosus Matsumura, Jour. College Sci., Imp. Univ. Tokyo 23: 18, 1908.

fasciatus (Ferrari) = fenestratus (Herrich-Schaeffer).

fenestratus (Herrich-Schaeffer)

Jassus fenestratus Herrich-Schaeffer, in Panzer, Faunae Insectorum Germanicae Initia oder Deutschlands Insecten, heft 122: 5, 1834.

Jassus (Deltocephalus) guttulatus Kirschbaum, Jahrb. Ver. Nat. Nassau, 21-22: 126, 1866.

Thamnotettix alboguttata Leithierry, Petite Nouvelles Ent. 1: 444, 1874.

Thamnotettix fenestrata var. **transversalis** Puton, Mitth. Schw. Ent. Ges. 6: 129, 1881.

Thamnotettix fenestrata var. **fasciata** Ferrari, Bul. Soc. Ent. Ital. 17: 288, 1885.

Thamnotettix fenestrata var. **venosa** Ferrari, Rev. d'Ent. 4: 59, 1885.

guttulatus (Kirschbaum)=fenestratus (Herrich-Schaeffer).

haematoceps (Mulsant and Rey)

Jassus haematoceps Mulsant and Rey, Ann. Soc. Linn. Lyon (2) 2: 229, 1885.

Jassus (Deltocephalus) rubrotinctus Kirschbaum, Jahrb. Ver. Nat. Nassau, 21-22: 125, 1868.

Jassus (Deltocephalus) opacus Kirschbaum, Jahrb. Ver. Nat. Nassau. 21-22: 126, 1868.

Thamnotettix opaca var. **minor** Ferrari, Ann Mus. Genova (2) 1: 514, 1864

haupti Zakhvatkin

Thamnotettix unicolor Haupt. Palestine Agric. Exp. Sta. Bul. 8: 34, 1927, **not Cicadula unicolor** Melichar, 1902

Circulifer haupti Zakhvatkin, Moscow Univ. Sci. Proc. 4: 111, 1935.

ignavus (Matsumura)=tenellus (Baker)

indivisus (Haupt)=tenellus (Baker).

inscriptus (Haupt)

Thamnotettix inscriptus Haupt, Palestine Agric. Exp. Sta. Bul. 8: 33, 1927.

jenjouriste Zakhvatkin

Circulifer jenjouriste Zakhvatkin, Royal Ent. Soc. London Trans. 96: 161, 1946.

minor (Ferrari)=haematoceps (Mulsant and Rey).

nausharensis (Pruthi)

Cicadula nausharensis Pruthi, Mem. Indian Mus. 11(3): 113-114, 1936.

opacus (Kirschbaum)=haematoceps (Mulsant and Rey).

rubicundula (Van Duzee)=tenellus (Baker)

rubrotinctus (Kirschbaum)=haematoceps (Mulsant and Rey).

salus (Matsumura) (new combination).

Thamnotettix salus Matsummura, Jour. College Sci., Imp. Uni. Tokyo 23: 21, 1908.

tenellus (Baker)

Thamnotettix tenellus Baker, Psyche 7 (suppl.): 24, 1896.

Thamnotettix rubicundula Van Duzee, Buffalo Soc. Nat. Sci. Bul. 8(5): 70, 1907.

Thamnotettix ignavus Matsumura, Jour. College Sci., Imp. Univ. Tokyo 23: 22, 1908.

Thamnotettix indivisus Haupt, Palestine Agric. Exp. Sta. Bul. 8: 35, 1927.

transversalis (Puton)=fenestratus (Herrich-Schaeffer).

unicolor (Haupt)=haupti Zakhvatkin.

unicolor (Melichar)

Cicadula unicolor Melichar, Wien. Ent. Zeit. 21: 78, 1902.

venosus (Fieber)=fenestratus (Herrich-Schaeffer).

vittiventris Lethierry

Cicadula vittiventris Lethierry, Soc. Ent. Belg. Ann. 19, C. R. p. lxxxiv, 1876.

THE SEVENTEENTH OR 1947 ANNUAL INSECT POPULATION SUMMARY OF KANSAS[1]

ROGER C. SMITH[2] and GEO. A. DEAN[2]
Kansas Agricultural Experiment Station

This insect population summary for Kansas covers the calendar year 1947 and is the 17th in a continuous series which began with the year 1931.[4] The information recorded here is based on a summary of 307 questionnaires of the score card type from the sources indicated in Table I, together with the observations and comments of the authors and their colleagues and of those returning the score sheets.[3]

TABLE I.

Source and Numbers of Questionnaires Summarized for This Report.

	No. in July	No. in October
Group 1. Entomologists in the State	8	12
Group 2. County Agricultural Agents	73	79
Group 3. Farmers, mostly college graduates	9	28
Group 4. Vocational Agriculture Teachers	27	50
Group 5. Agronomists and Horticulturists	9	12
Total reports of each groups	126	181
Grand total of all questionnaires summarized for this report	307	
Number of counties reporting	97	

Summary of Weather Conditions (Fig. I and Table II) in Kansas by Months During 1947[5]

January averaged mild and pleasant with more sunshine and less precipitation than usual. It opened with rather heavy snows and some of the coldest weather ever known in the eastern part of the state on the 4th. Snowfall was heavier than usual and was well distributed over the state but the total fall of moisture was generally deficient, except in some western counties where it was slightly above normal. Soil moisture conditions continued ample for current needs except in some south-central counties. Wheat remained in excellent condition and made some growth during the mild weather.

---

[1] Contribution No. 561 from the Department of Entomology.
[2] Entomologists of the Kansas Agricultural Experiment Station.
[3] Recognition and appreciation for assistance given during the preparation of this summary are due to the same sources and largely to the same individuals who supplied information for recent, previous reports. The questionnaires were sent to the county agents by E. G. Kelly, extension entomologist, who also read the manuscript critically.
[4] For the other summaries in this series, see the **Journal of the Kansas Entomological Society** for the summaries for 1931 (vol. 5); 1932 (Vol. 6); 1933 (vol. 7); 1936 (vol. 10); 1937 (vol. 11); 1939 (vol. 13); 1942 (vol. 16); 1943 (vol. 17); 1944 (vol. 18); 1945 (vol. 19); and for 1946 (vol. 20). The **Transactions of the Kansas Academy of Science** for 1934 (vol. 38); 1935 (vol. 39); 1938 (vol. 42); 1940 (vol. 44); and for 1941 (vol. 45).
[5] Notes and Table II based on Climatological Data: Kansas Section Weather Bureau, U. S. Dept. of Commerce by S. D. Flora. Vol. 61, 1947.

TABLE II

Summary of Weather Data for the State of Kansas for the period September 1, 1946 to December 31, 1947.

From U. S. Weather Bureau, Kansas Section, Vol. 61.

Month	Temperature in degrees Fahrenheit					Precipitation in inches					
	State Mean	Maximum	Minimum	Mean for 61 years	Departure from normal	State Average	Average for 61 years	Departure from normal	Eastern third	Middle third	Western third
1946											
September	68.9°	107°	27°	69.7°	—0.8°	3.66	2.86	+0.80	4.27	3.80	2.99
October	58.4°	92°	25°	57.3°	+1.1°	4.22	1.99	+2.23	2.99	3.81	5.87
November	42.9°	77°	5°	43.3°	—0.4°	2.56	1.27	+1.29	2.34	2.29	3.05
December	38.7°	78°	—12°	33.1°	+5.6°	0.57	0.89	—0.32	1.26	0.42	0.04
1947											
January	32.9°	75°	—35°	30.1°	+2.8°	0.58	0.70	—0.12	0.63	0.57	0.53
February	31.4°	78°	— 9°	33.3°	—1.9°	0.32	0.98	—0.66	0.40	0.32	0.24
March	39.0°	86°	—14°	43.5°	—4.5°	2.47	1.48	+0.99	3.63	2.36	1.42
April	52.5°	91°	21°	54.8°	—2.3°	4.67	2.71	+1.96	7.17	4.63	2.21
May	60.9°	96°	27°	63.8°	—2.9°	4.50	3.81	+0.69	4.85	4.42	4.23
June	71.8°	105°	36°	73.8°	—2.0°	5.20	4.03	+1.17	7.11	5.24	3.25
July	77.6°	111°	45°	79.2°	—1.6°	1.91	3.10	—1.19	2.06	1.72	1.96
August	83.2°	111°	52°	78.0°	+5.2°	1.84	3.15	—1.31	2.26	1.54	1.73
September	74.0°	117°	30°	69.8°	+4.2°	1.40	2.83	—1.43	3.27	0.47	0.46
October	65.8°	104°	25°	57.5°	+8.3°	1.29	1.98	—0.69	2.11	1.06	0.69
November	39.5°	72°	— 8°	43.2°	—3.7°	1.15	1.27	—0.12	1.38	1.06	1.01
December	34.5°	73°	— 6°	33.1°	+1.4°	2.07	.89	+1.18	2.71	2.33	1.16
Averages, totals or extremes for 1947	55.2°	117°	—35°	55.0°	+0.2°	27.43	2.25	+0.48	37.60	25.74	18.94

February was the coldest experienced in Kansas since 1939 and had less precipitation than any other February in 11 years. The three-month winter period, which it completed, was the driest in 11 years and the sixth driest winter the state has experienced in 60 years. The top soil was dry, and dust storms occurred on the 6th and on a few other days in western counties. Wheat was largely dormant and made little growth. Abnormally cold weather occurred the last 10 days of the month. The main precipitation occurred from snows of the 7th and 28th.

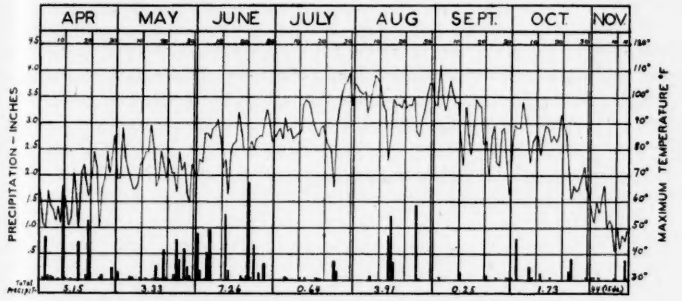


Fig. 1. Daily rainfall and temperature chart for the growing season of 1947, at Manhattan, Kansas. Chart prepared by D. A. Wilbur.

March was unusually cold, cloudy, and wet, but wheat made good growth the latter part of the month. Rains and snows were more frequent than usual and precipitation was well above normal, except in some extreme western counties.

April was a cool, rainy, cloudy month. The spring was cold, wet, cloudy, and from two to four weeks late. It was the 5th wettest April in 61 years. There were a few days in the eastern half of the state when the soil was dry enough for working. Wheat, alfalfa, and blue grass made excellent growth, but the planting of corn, oats, and barley was delayed. Fruit bloom appeared later than usual and bees had few days for flight. Peaches were practically all frozen in January. Warm, sunshiny weather was needed.

The 35° F. below zero weather in January, or late freezes in April, caused extensive killing above ground of arbor vitae. Many hedges were killed completely and individual trees in nurseries and around homes either were killed or showed many dead branches. No such extensive killing of arbor vitae by freezing weather had occurred within the memory of observers.

May was cool and wet. It was the fourth consecutive month with below normal temperatures, and rain fell some place in the state practically every day in the month. Freezing weather on the 29th established new low temperature records in many places in the state. Wheat continued in excellent condition, except for injury from freezing in Smith, Osborne, and Phillips counties.

June was characterized by excessively wet weather except in the southwest and south-central counties. Temperatures averaged below normal and cloudiness was excessive. Rains were unusually frequent, falling in some part of the state every day of the month.

July had sufficient rainfall in nearly every part of the state and temperatures averaged below normal. The month closed with a hot spell of almost record-breaking severity.

August was the hottest for this month the state had experienced since 1937 and the driest since 1936. Rains were infrequent and temperatures rose above 100° F. on from 10 to 15 days in nearly all parts of the state. Nights were abnormally warm for the time of year. There were few cool periods during the month. Corn began to deteriorate early in the month, and, by the latter part of August, much was damaged beyond recovery. Grain sorghums were retarded, but preparation of the soil for wheat progressed well. Pastures deteriorated greatly in regions of scanty rainfall.

September was above normal in temperature and deficient in rainfall, making this one of the driest on record. Wheat sowing made little progress, pastures dried up, and corn deteriorated further.

October was the warmest on record and was deficient in rainfall, especially over the western counties. For the state as a whole, the three-month period ending with October was the driest on record, with the exception of 1939. Over the western third, it was the fourth driest in 60 years. Sowing wheat made good progress over the eastern half of the state, but much of the intended acreage was not seeded due to lack of soil moisture.

November was exceptionally cool and cloudy, with frequent light rains. The first killing frosts occurred in the eastern two-thirds of the state on the 5th and 12th, which are unusually late dates.

December had a heavier fall of moisture than any month since June. Temperatures were mild for the time of year. It was a favorable month for wheat and livestock.

CROP PRODUCTION SUMMARY FOR 1947[6]

The total acreage of all crops harvested in 1947 was 23,586,000 acres compared with 22,558,000 acres in 1946. The total farm value of all Kansas crops produced in 1947 of $930,275,000 was the highest on record and compared with the 1946 crop production value of $640,928,000. The Kansas 1947 wheat production of 286,702,000 bushels exceeded the previous largest crop in 1931 by 34,817,000 bushels. It was the largest acreage ever harvested with a per acre yield which had not been exceeded since 1914. The 1947 wheat crop value was placed at $673,750,000.

Conditions for seeding winter wheat in the fall of 1946 were very favorable and moisture supplies for development of the crop were adequate for abundance throughout the season. Condition for planting and growth of corn, oats, and other spring planted crops, however, were unfavorable. An

[6] From Kansas 1947 Crop Review, Kansas State Board of Agriculture, Statistics Division, December 19, 1947. Mimeographed Release.

unusually late, wet spring delayed plowing and planting, after which the weather turned off unusually hot and dry during the summer and fall. This resulted in poor yields, with considerable acreage of corn and sorghums having to be cut for forage and silage and relatively large abandonment occurring in some sections. A late fall with dry open weather permitted harvest of late crops without material loss or damage from frost.

Corn and other crops. Corn planting was delayed by the late, wet spring, and the crop was severely damaged by the hot, dry August weather. Corn production was estimated at 40,443,000 bushels, compared with 63,231,000 bushels in 1946, and was the smallest crop since 1939. Harvested acreage was down 21 per cent from 1946. Average yield per acre was 17 bushels, while the average yield per acre for 1946 was 21 bushels. Production of **sorghums** for grain was estimated at 10,933,000 bushels compared with 11,488,000 bushels in 1946, which was the smallest crop since 1939. Sorghum forage production of 1,385,000 tons compared with 2,083,000 tons in 1946. **Oats** production was estimated at 40,455,000 bushels which was only slightly less than in 1946, and compared with the 10-year average of 35,942,000 bushels. **Barley** production at 6,380,000 bushels compared with 5,022,000 bushels last year and the 10-year average of 12,051,000 bushels.

Soybeans and Flaxseed—the 1947 soybean production was estimated at 1,887,000 bushels compared with 2,178,000 bushels in 1946. **Flaxseed** production was 749,000 bushels compared with 812,000 bushels in 1946. The flaxseed acreage was 8 percent less than in 1946.

Hay and Seed Crops—Kansas production of all hays totalled 3,116,000 tons, compared with 2,327,000 tons in 1946. There was increased acreage of alfalfa as well as a good crop. The alfalfa hay production, included in the above totals, was 1,981,000 tons in 1947, compared with 1,569,000 tons in 1946. The prairie or wild hay production, included in the above totals, was 772,000 tons compared with the crop of 478,000 tons in 1946. Said crops harvested this year and last year, respectively, were as follows: **alfalfa** 311,000 and 448,000 bushels; **red clover** 61,000 and 53,000 bushels; **sweet clover** 161,000 and 120,000 bushels; **lespedeza** 6,100,000 and 8,400,000 pounds; **Sudan grass** 2,100,000 and 1,600,000.

Other Crops. The Kansas production of potatoes was estimated at 1,188,000 bushels, compared with 1,632,000 in 1946 and the 10-year average of 2,200,000 bushels. **Broom corn** production at 1,100 tons was sharply below the 1946 production of 1,700 tons. **Popcorn** production in 1947 of only 2,660,000 pounds was sharply below the 1946 production of 6,240,000 pounds. Kansas had a good season for **apples**, with a commercial crop of 755,000 bushels compared with 514,000 in 1946; it was the largest crop since 1940. Production of other fruit this year and last year were as follows: **peaches** 12,000 and 154,000 bushels; **pears** 99,000 and 90,000 bushels; **grapes** 1,900 tons and 1,600 tons.

Honey Crop. The estimated honey crop for 1947 was 2,560,000 pounds, or an average yield of 40 pounds per colony, compared with 3,360,000 pounds, or an average yield of 56 pounds per colony, in 1946. The amount of **beeswax** for 1947 was 54,000 pounds, compared with 67,000 pounds in 1946.

DESCRIPTIVE ACCOUNT OF THE MORE IMPORTANT INSECT ACTIVITIES AND CLIMATIC RELATIONSHIPS DURING 1947

Ants were approximately as numerous and annoying in the spring and summer, as usual, but the swarming species prompted somewhat more inquiries than usual during the fall. The yellow ant caused fewer inquiries in the spring, but swarms of the little black ant, pavement ant, the acrobat ant, and perhaps some other species reached peak numbers during October.

Aphids were about equal to 1946 in population and, in general, probably normal in population, although the pea aphid and the green ash aphid attained considerable numbers. Aphids were scored at 3 on shrubs in Hamilton County; at 4 on sorghums in Haskell and Ellis counties; at 3 elms in Graham County; at 2 on melons and cucumbers in Atchison County, and from 2 to 4 on gardens and flowers in many counties.

Fire blight, which usually is regarded as being, in part, transmitted by aphids and other insects, was more abundant in orchards and nurseries during 1947 than in any other year since 1935.

Aphids on snowball, chrysanthemums, and **spiraea** were definitely less numerous than last year.

Apple aphids were plentiful in orchards in northeast Kansas, but good control was obtained by use of oil sprays and no damage was done.

Green bugs which are aphid pests of wheat and oats in the spring, were widely distributed in the state during April and May, but little damage occurred. The bugs were more plentiful in 1947 than in 1946. They reached considerable numbers on wheat by the latter part of May, but the crop was then too advanced for serious damage. Some growers ascribed thin, poor stands of wheat to green bugs, but this was not proved. Wheat grew so rapidly during May and June that it was doubtful whether these insects caused

---

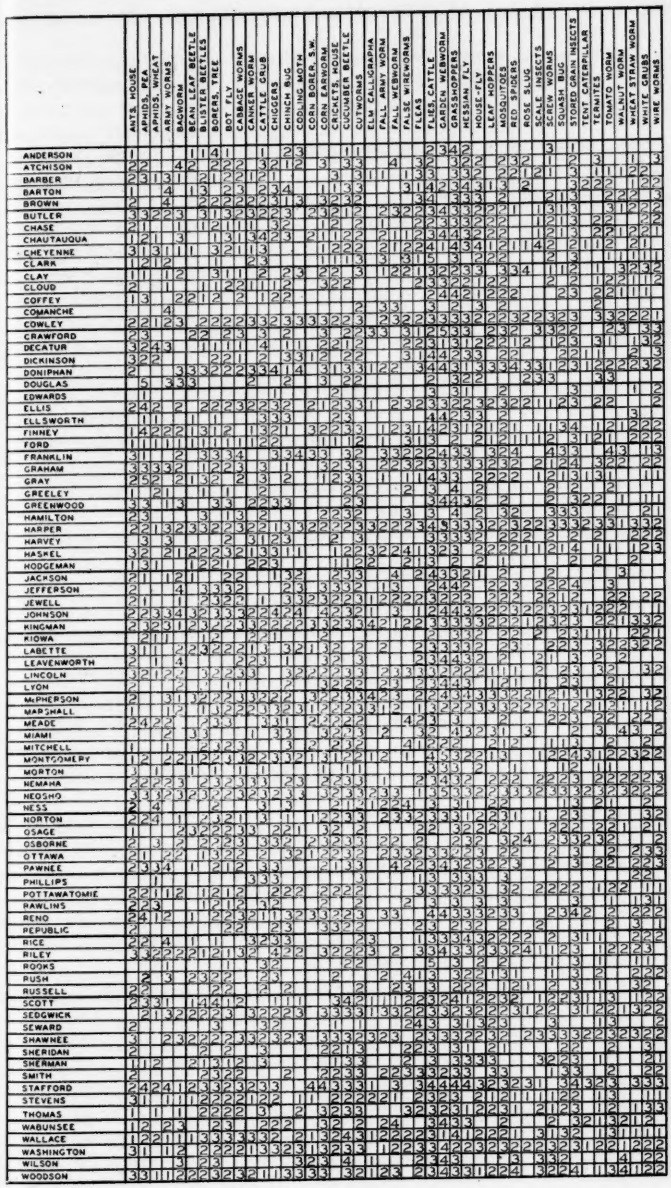
TABLE III.

Population summary of the more common and important insects in Kansas for 1947, as indicated by questionnaire score sheets from nearly all counties.

KEY

1. Scarce.
2. Plentiful, but damage was neither noticed nor reported.
3. The species was abundant. Some damage was either seen or reported.
4. Local outbreaks. The species was doing severe damage in certain fields.
5. The species was in general outbreak. The insects were doing their greatest damage or were as plentiful as they ever get in a locality.

NOTE: This table represents the population scorings by counties for each species of insect listed in the questionnaires, in so far as reported. To use it to best advantage, copy the scores for each species in the counties of a state map.


ANTS, HOUSE
APHIDS, PEA
APHIDS, WHEAT
ARMYWORMS
BAGWORM
BEAN LEAF BEETLE
BLISTER BEETLES
BORERS, TREE
BOT FLY
CABBAGE WORMS
CANKER WORM
CATTLE GRUB
CHIGGERS
CHINCH BUG
CODLING MOTH
CORN BORER, S.W.
CORN BORER, N.E.
CROP & HOUSE
CUCUMBER BEETLE
CUTWORMS
ELM CALLIGRAPHA
FALL ARMY WORM
FALL WEBWORM
FLEA WEEVILS
FLEAS
FLIES, CATTLE
GARDEN WEBWORM
GRASSHOPPERS
HESSIAN FLY
LEAF HOPPERS
MOSQUITOES
RED SPIDERS
ROSE SLUG
SCALE INSECTS
SCREW WORMS
SMUT
STORED GRAIN INSECTS
TENT CATERPILLAR
TERMITES
TOMATO WORM
WALNUT WORM
WHEAT STRAW WORM
WHITE GRUBS
WIRE WORMS
ANDERSON
ATCHISON
BARBER
BARTON
BROWN
BUTLER
CHASE
CHAUTAUQUA
CHEYENNE
CLARK
CLAY
CLOUD
COFFEY
COMANCHE
COWLEY
CRAWFORD
DECATUR
DICKINSON
DONIPHAN
DOUGLAS
EDWARDS
ELLIS
ELLSWORTH
FINNEY
FORD
FRANKLIN
GRAHAM
GRAY
GREELEY
GREENWOOD
HAMILTON
HARPER
HARVEY
HASKEL
HODGEMAN
JACKSON
JEFFERSON
JEWELL
JOHNSON
KINGMAN
KIOWA
LABETTE
LEAVENWORTH
LINCOLN
LYON
McPHERSON
MARSHALL
MEADE
MIAMI
MITCHELL
MONTGOMERY
MORTON
NEMAHA
NEOSHO
NESS
NORTON
OSAGE
OSBORNE
OTTAWA
PAWNEE
PHILLIPS
POTTAWATOMIE
RAWLINS
RENO
REPUBLIC
RICE
RILEY
ROOKS
RUSH
RUSSELL
SCOTT
SEDGWICK
SEWARD
SHAWNEE
SHERIDAN
SHERMAN
SMITH
STAFFORD
STEVENS
THOMAS
WABUNSEE
WALLACE
WASHINGTON
WILSON
WOODSON

appreciable damage either to wheat or oats during the season, except in certain northwest counties. Many acres of stunted plants with poorly filled heads in Norton, Decatur, Graham, Rawlins, and Cheyenne counties were thought to have been injured by green bugs. Some fields were dusted with benzene hexachloride by planes. Lady beetles became so numerous by the later part of May that there were good reasons for believing that they were of first importance in controlling the green bug.

The **pea aphids** were more numerous than in 1945 or 1946. They attained damaging numbers over most of the state during early May and caused some injury to alfalfa, particularly in the western half of the state. Many fields, especially in southwestern counties, showed short, bunchy growths, particularly in spots, characteristic of the damage by this insect. The first cuttings in some fields in Ellis, Rice, Barton, and Pawnee counties were reported at nearly a total loss. Had growing conditions been poor, the first cutting of alfalfa would have been reduced and the quality lowered by pea aphids over most of the state; but the frequent rains enabled alfalfa to overcome an abnormally large population of these pests and relatively little loss in production or vigor of stands was observed or reported. The peak population was not reached until the first week of May, which is ordinarily too late for greatest injury to the crop.

Pea aphids were reported on peas in Douglas, Ellis, Meade, and Hamilton counties.

Armyworms developed in local outbreaks during May and June in wheat and oat fields in many areas in eastern Kansas. The species concerned were the wheat-head armyworm and the true armyworm. As usual, these larvae were mostly discovered in wheat that had lodged badly. Many statements of armyworm damage to corn, wheat, and alfalfa were reported by the press and radio. Specific localities of observed damage were at Lincoln, Hays, and elsewhere in central Kansas, and in Brown, Douglas, and Johnson counties. The wheat-head armyworm was reported in mid-June as causing extensive injury to the heads, leaves, and beards of wheat, oats, and brome grass.

Bagworms on evergreens, while common, were slightly less numerous and less destructive than in 1946. The reduction was probably due to the application of control measures. When uncontrolled in nurseries, they were common in the eastern three tiers of counties. They were reported for more western counties than in any of the last three years. Many evergreens were observed to have been killed by bagworms during 1946 and the trees had not yet been removed in 1947.

Bean leaf beetles were less numerous and destructive than in 1945 or 1946. They became abundant and destructive only to the foliage of late beans. They were noted in greatest numbers in the eastern third of the state in July and August.

Black flies were reported to be a pest of livestock in Pottawatomie County in mid-April.

Blister beetles had about the same population in 1947 as in the two previous years. They were not particularly numerous or troublesome in gardens

or on field crops. The striped species was numerous in many small areas in alfalfa fields. Blister beetles were reported damaging alfalfa in Brown, Woodson, Labette, Cloud, and Finney counties, and in gardens in Doniphan, Wyandotte, Woodson, Scott, and Gray counties.

Bees produced only about half a crop of honey in the region of Manhattan, but a full, normal crop was obtained in southeast Kansas. Bees were severely handicapped during the cold, wet, late spring because there were so few days they could fly, and maple, fruit tree, and dandelion blooms came later than usual. Many colonies had to be fed. In the region of Manhattan, they were not self-sustaining until early June. The large amount of rainy weather during June prevented maximum nectar gathering and the hot dry weather which arrived about mid-July cut off the nectar flow sharply. There was no fall nectar flow in many localities.

Borers in fruit and shade trees were equal to the numbers reported the two previous years. The hot, dry weather after mid-July favored them. Borers were reported in **peach** trees in Doniphan, Wyandotte, Neosho, Nemaha, Cowley, and Reno counties; in **apple** trees in Nemaha, Wyandotte, Johnson, and Woodson counties; in **cherry** trees in Nemaha, Neosho, and Cowley counties; in **locust** trees in Anderson and Meade counties; in **poplar** and **cottonwood** trees in Clay and Kiowa counties; in **elms** in Norton, Scott, and Gray counties; and in other trees in Russell and Ellis counties.

Bot flies were scored lower and reported from fewer counties in 1947 than for the two previous years. The decline in the number of horses may be responsible for the gradual reduction of the numbers of bot flies.

Boxelder bugs were more numerous and annoying during the fall of 1947 than they had been since the early forties. They were not observed to have been unusually plentiful during the summer but they congregated about the south sides of many homes during the fall, causing more complaints than usual.

Buffalo and **varied** carpet beetles were exceptionally numerous at windows in Riley County on April 24, just as spiraea was coming into bloom. These insects appeared about three weeks late but they were more plentiful than in recent years.

Cabbage worms were about equal in numbers to the two previous years, questionnaire reports indicated. Somewhat fewer counties reported them, but there were more 3 and 4 scores than in 1946. The two species of cabbage worms caused most inury to late cabbage.

Cankerworms were approximately as numerous in 1947 as in 1946. They caused marked foliage injury only in Topeka and certain other localities in counties of the eastern half of the state. The moths were observed to be scarce at Manhattan and northeast Kansas during March and April. The peak of moth emergence did not occur in Manhattan until about April because of the cold, backward season. Elms did not produce seed until the latter part of April, and at no time were cankerworms observed to be more than occasional. No foliage damage was observed. They were reported on apple trees in Doniphan County. Observers reported about the usual amount of

damage to elms in the fields in the country in the southeastern one-fourth of the state.

Cattle grub flies were reported as having been much less numerous than in 1946. They were most abundant in the groups of counties in the four corners of the state. Most of the counties scored at 3 are in the western half of the state. No doubt, extension programs for the control of cattle grubs reduced the numbers somewhat, and made cattle producers more aware of these pests.

Chinch bugs were of small consequence in Kansas during 1947. They were scored below the two previous years and from fewer counties. They passed the winter in fair numbers, and a larger number than expected was observed in many thin stands of wheat in the Manhattan area. The cold, wet, backward spring, however, was unfavorable to them, and in most places in the state they did not attain threatening numbers. Control practices were applied in only a few localities and only slight damage was done. Chinch bugs were reported on sorghums in Neosho, Republic, Ellsworth, Barton, and Gray counties; on corn in Woodson and Cowley counties; and on wheat in Russell and Ness counties. The fall chinch bug survey revealed the smallest number of chinch bugs in hibernation since 1924.

Cicadas were more numerous in Kansas during 1947 than since 1930, when brood 15 of the seventeen-year species had previously occurred. However, both this and the ordinary two-year species were especially plentiful and were the cause of many newspaper articles and other comment. The seventeen-year cicada began to appear in wooded areas in early June and their distinctive noise continued throughout most of July. This species occurred in large numbers only in scattered woodlands in eastern Kansas, but they were observed also laying eggs and resting in numbers in some orchards, nurseries, and young groves. The total damage done by oviposition was probably slight. The brood is believed to have been larger and more numerous than in 1930.

The common cicada (**Tibicen pruinosa**) occurred throughout the eastern half of the state and the "singing" was so intense and general during the summer as to cause annoyance to many persons.

Clover seed chalcids were observed as plentiful during 1947, and alfalfa seed was more severely damaged by this species than usual. There was also more correspondence regarding this species, which some correspondents called "weevil," than usual.

Clover stem borer (Languria mozardi) was unusually plentiful this year in the eastern third of the state where it attacked alfalfa, sweet clover, and crimson clover. Many specimens were sent in for identification. It was reported at a meeting of beekeepers in northeast Kansas in mid-July that this insect had been so numerous that it caused cessation of nectar production in affected plants. This is the first time for many years that this insect has been numerous.

Codling moths in unsprayed orchards were approximately equal to 1946 and normal in numbers, but where orchards were properly sprayed, and particularly where DDT was incorporated in some of the cover sprays,

codling moths were less of a factor than usual. Elbert Eshbaugh, Wathena, Kansas, reported the first codling moths taken in emergence cages on May 21. This was about a month later than in 1946. Large catches of codling moths were taken in bait traps during the first ten days of June, and the second generation moths began to emerge on July 11. The development of the second brood was more rapid because of the hot, dry weather. A partial third brood began to develop August 23. The first cover spray was applied June 3.

Codling moth control in the properly sprayed orchards was the best ever obtained. A fairly large number of larvae from the third brood formed nests under the bark or in protected places so that something near the normal spring population can be expected.

Colorado potato beetles were not much more numerous than in 1946, although the species seems to be increasing slightly in numbers. Many gardeners applied insecticides to their potato crop largely as precautionary measures because individual plants throughout the state were heavily infested with them. It is doubtful whether commercial growers found it necessary to apply insecticides.

Corn earworms attained large numbers during 1947 and were judged to be somewhat more numerous and destructive than in 1946. Sweet corn was attacked severly by the second generation but, in general the first and second generations were probably no more abundant than usual. The third generation was more abundant and destructive than usual on late corn, sorghum heads, and soybeans. Corn, in general, was planted late because of the cold, wet spring. The third generation, therefore, had more soft corn available for food. The damage to field corn throughout the state was, in general, severe. More reports of damage to sorghum heads in central and western Kansas were received than for a half dozen years. The species was likewise extremely plentiful in alfalfa, but probably no more so than usual. The large third generation gave rise to great numbers of moths. R. H. Painter reported an exceptionally heavy flight about lights at a football game the latter part of October. Practically all of the moths seen were of this species and they rested on the walls of buildings at the rate of three or four to the square foot.

Corn root worms were plentiful in the main corn growing counties along the northern border of Kansas in 1947. Fallen corn in these counties showed the root system markedly reduced. While the southern and western species were the common ones present, there was evidence that another species was involved. H. R. Bryson and D. A. Wilbur stated that the species might be the so-called New Mexican corn root worm, judging by the several adults from Smith and Phillips Counties brought in and from the type of silk injury by the beetles.

Corn sap beetles (Carpophilus dimidiatus) were extremely abundant in the ears of early sweet corn in Riley County at mid-July. This species has not been observed in such large numbers in recent years.

Crickets had about the same population as last year. They caused about the normal number of inquiries because of entering homes, especially basements, during the hot, dry portion of the summer. They were reported from all parts of the state.

Tree crickets were somewhat more numerous than usual during August. They were observed more numerous than ever before when seen in flight in this community on the evening of August 9. Egg scars on stems of plants appeared to be somewhat more numerous than usual in the fall.

Cucumber beetles were reported from nearly every county, and were comparable in numbers and damage to 1946. They were reported on melons in Neosho, Nemaha, Smith, and Scott counties.

Cutworms were more numerous and destructive in the spring of 1947 than in 1946. They were observed as plentiful in gardens during the latter part of April, and about the normal number of letters of inquiry were received concerning damage to alfalfa and corn. The cold, wet spring was favorable for them, and corn in some fields in the eastern half of Kansas was severely attacked. Cutworms were reported in **gardens** in Doniphan, Wyandotte, Neosho, Greenwood, Cowley, Comanche, Ellis, Osborne, Smith, Norton, Thomas, Greeley, Gray, and Morton counties; as attacking **corn** in Nemaha, Washington, Clay, Harvey, Greenwood, Neosho, Phillips, and Cheyenne counties; in **wheat** in Leavenworth, Cowley, Smith, and Finney counties; in **barley** in Harvey and Reno counties; in **rye** in Labette; in **oats** in Graham; and in **alfalfa** in Rawlins and Reno counties.

Elm calligrapha beetles were less numerous and destructive in 1947 than in 1946. The populations and damage were largely confined to individual trees in various towns in central and south-central Kansas. It is believed that many trees were sprayed, either as a control for an infestation causing damage, or as a precautionary step in many of the cities in this area.

Elm seed wing midges. There was a large elm seed crop, but the midge larvae were neither seen nor reported.

The **European corn borer** was collected by LaVere Calkins and R. G. Yapp in the following 12 counties in Kansas in 1947: Atchison, Coffey, Doniphan, Douglas, Jefferson, Johnson, Leavenworth, Linn, Miami, Osage, Shawnee, and Wyandotte. The major survey was made during June to discover the stalks damaged by the first generation larvae. A brief survey during the latter part of August and early September revealed no second brood larvae. Most of the infested corn was sweet corn being grown in gardens in the towns. This is the largest number of counties ever found to be infested by this species in one year. It is also the first time that the borer has been taken as far west as Shawnee and Coffey counties.

European elm scale was discovered on elms in several additional towns of northwest Kansas not known previously to have this pest. They included, particularly, Colby and Sharon Springs. The previously reported infestation in St. Francis was surveyed by R. G. Yapp and found to be extensive. Vigorous spraying with miscible oil in March and DDT in June apparently reduced the infestation there. This was the first year that summer control

consisting of spraying infested trees with DDT to destroy the crawling young was practiced, and excellent results were obtained.

Fall armyworms were more numerous during the late summer and fall of 1947 than in 1946. They were reported attacking **alfalfa** in Crawford and Labette counties and **corn, rye,** and **wheat** in Franklin County.

Fall webworms were slightly more plentiful during the late summer of 1947 than in 1946, and were reported more widely in western Kansas than usual. The distinctive webs were observed to be fairly numerous in the eastern third of the state during the latter part of August. The reporters for Nemaha, Osage, Douglas, Coffey, Crawford, Labette, and Montgomery counties reported fall webworms on alfalfa, indicating that this insect was confused with the garden webworm. Perhaps the scores of 3 and 4 recorded for this species in Table III represent a similar mistake.

False wireworms were slightly more plentiful than in 1946, and were widely reported throughout the western third of Kansas during September and October. The abnormally dry fall was ideal for maximum injury by these insects which destroyed sown wheat when germination was delayed by drouth. Many farmers did not sow their wheat until late October and during November, partly to avoid loss by these insects. They were reported specifically in wheat fields in Mitchell, Russell, Ellis, Finney, and Haskell Counties. **Eleodes opaca** occurred widely in the western third of the state and **Eleodes suturalis** was apparently widely distributed in central Kansas.

Fleas in homes and on pets, while reported all over the state, were probably slightly below 1946 and were average for the state. They occurred particularly during the hot summer, possibly as the result of pets being allowed the run of basements to escape the heat.

Flies on livestock, other than horse flies, while reported at 2 to 4 for nearly every county, were considerably less numerous and annoying than in 1946 or for a number of years. Horn flies, stable flies, and house flies were rather slow to reach noticeable numbers in the spring, but stable flies attained fair numbers by June 15. The absence of flies around homes and restaurants, largely if not wholly due to the use of DDT, was a subject of conversation and newspaper comment during the season. The widespread spraying of cattle and barns was likewise responsible for the small number of horn flies on cattle and stable flies around barns. There were 426 power sprayers used in Kansas for treating cattle for horn flies and 11,869 hand sprayers used for treating barns, houses, and cattle. There were 68,992 farmers treating 1,939,560 head of cattle and 27,456 barns for stable and house flies. The reporters in many counties scored flies on cattle at 4 or 5 where the cattle were not sprayed with DDT, but 1 or 2 where they were sprayed.

Screw worm flies were fairly common all season, but there were no peaks or outbreaks observed or reported. It is thought that they were less numerous and less destructive than in 1946 or for several years. They occurred particularly in areas around the city stockyards and the rest yards for cattle at El Dorado, Yates Center, and Dodge City.

Horse flies, especially **Tabanus sulcifrons,** began to annoy livestock in southeast Kansas about the middle of July. R. L. Parker observed them

resting in that area on the highway and on automobiles. By the latter part of July, they constituted a major livestock problem in central Kansas and continued as such until near the end of August. They were more frequent than ever observed on the cool and shady sides of homes far from livestock. Horse flies were mentioned in reports from Atchison, Lyon, and Butler counties.

There were many efforts to protect domestic animals with various sprays, but a combination of DDT and BHC gave fair results. This outbreak prompted a vigorous correspondence and frequent articles in the press. It is not known why these insects attained such large numbers. The hot, dry season caused most of the streams and ponds to be low and many to go dry.

Garden webworms occurred in the severest and the most wide-spread outbreak which has occurred in the state of Kansas in 25 years. The outbreak could have been predicted from the large number of moths which were seen and reported throughout June in the eastern half of the state. The first generation was of no consequence since it was confined to weeds, especially pigweeds. Dahlies were attacked, and in some cases the foliage was severely webbed and eaten by this generation. The second generation which developed the latter part of June and in early July was widesprad and serious. Corn, alfalfa, soybeans, cowpeas, and small grains were severely attacked. The injury to corn was more severe than was seen or reported in this state for many years. Many farmers sprayed or dusted their corn with a combination of DDT and benzene hexachloride with fairly good results reported. Others employed airplane companies to dust their fields to control garden webworms. This is the first time in the history of the state that airplanes were used commercially to control corn and alfalfa insects. The larvae occurred in fields over a period of two to three weeks. In some fields of alfalfa being left for seed, the buds and blossoms were severely damaged, reducing seed yield prospects materially.

Ordinarily, the third generation of garden webworm is of no consequence, but during August the third generation was fully as numerous and serious as the second. The drouth and hot weather made crop growing conditions difficult, so when attacked suddenly by a large third generation of webworms some fields were virtually ruined. Both the fact that the third generation did widespread, serious damage, and that it was of such short, intense duration were new and unusual features of the behavior of this insect in 1947. It was stated that 85 per cent of the alfalfa fields in the Kansas and Blue Valleys were damaged by the third generation of this insect. The dehydrating plants in the Kansas Valley closed temporarily because the crop was unsuitable for processing. Most reports of abundance and damage came from the eastern half of the state. So far as known, this insect was somewhat less plentiful in the western half of the state than usual.

Garden webworms were reported in **alfalfa** fields in Doniphan, Wyandotte, Franklin, Neosho, Labette, Montgomery, Dickinson, Clay, Riley, Cloud, Ellsworth, Pawnee, Gray, Finney, and Graham counties.

Gnats (mostly midges) became so numerous around lights in Riley County at mid-August that they entered homes through the screens and became a household annoyance.

Grasshoppers were about equal to 1945 but below 1946 in numbers. They were not particularly abundant nor destructive in Kansas during 1947. They were of economic importance only in some 21 western counties during the fall and in small isolated patches in many areas in the state. The impression prevailed that grasshoppers increased slightly in 1947 over the previous year.

Fred D. Butcher stated on May 28 that about 50 per cent of the grasshopper eggs were still unhatched and that about 20 per cent of the nymphs were in the third instar. This is explained by the fact that the season was several weeks late. Ey July 1 John S. Riss of the Bur. of Ent. and P. Q., determined that there would be a large, late hatch in the Elkhart District which might cause serious damage to late young corn, milo, and fall planted wheat. In eastern Kansas, by this time, the nymphs of the migratory species were generally one-third to one-fourth grown, and some damage was observed in flower and vegetable gardens. Mr. Butcher reported some grasshopper flights in the Garden City area on July 11 and 12. It was a light flight since only about 22 per cent of the grasshopper population there were adults. The distribution was observed to be very uneven, ranging from three to the square yard in fields, to one hundred at the edges of fields. About 15 per cent of the early nymphs died because of inclement weather. About ten per cent were affected by fungus disease in some areas. Egg deposition by the first generation of adults was general and spread over a long period of time. Practically all eggs deposited before August hatched so that the eggs laid in September wintered. In mid-August, grasshoppers were observed to be plentiful in small areas in the northeastern quarter of the state. They attacked especialy corn, rhubarb, iris, and some ornamental plants. News items recorded their damaging the blossoms of alfalfa and red clover being left for seed.

Grasshoppers were reported in **alfalfa** in Wyandotte, Leavenworth, Douglas, Shawnee, Osage, Lyon, Neosho, Crawford, Labette, Chautauqua, Kingman, Harper, Russell, Pawnee, Norton, and Sherman counties; in **wheat** in Douglas and Norton counties; in **corn** in Woodson and Osage counties; in **gardens** in Smith and Kingman counties; and in **pastures** in Wabuunsee County.

By the latter part of September, approximately 25,000 square miles of roadside were treated with poison bran mash for grasshopper control in western Kansas. This area included counties west of Decatur, south across Sheridan, Gove, Scott, Finney, Haskell, and Seward, west to the Colorado line. The migratory grasshopper was the dominant species. Most of the bait was made with sodium fluosilicate, but chlordan was used for the first time with satisfactory results. However, the cost of using chlordan was thought to be high. The only damage in western Kansas was to the foliage of corn along the field borders.

Hackberry psyllid adults of at least three species were observed numerous during the spring, after the buds were bursting, but they were less numerous during the fall than in 1946. The number of nipple galls was as large as in previous years. The adults were reported in numbers in homes during September by only one correspondent.

Hessian fly was less plentiful in Kansas than in 1946. This pest might have occurred in a great state-wide outbreak in 1947 if Pawnee wheat, which is resistant to hessian fly, had not been so generally planted in the western half of the state. This insect was not especially abundant anywhere in the state in the spring, except in individual fields in a few widespread localities. Heavy infestations of the fly up to mid-April were reported by E. T. Jones as "rare and spotted."

The U.S.D.A. hessian fly survey of the 1947 wheat crop revealed the following stem infestation in the different parts of Kansas:

Areas	No. of counties	No. fields sampled	Stems infested	
			Average Percent	Percent Maximum
Northwest	12	79	5.8	68
Southwest	11	42	0.1	4
Northcentral	16	123	6.97	52
Southcentral	18	129	15.6	98
Northeast	15	111	6.9	86
Southeast	12	61	7.8	64

Weather conditions for growth of wheat were almost perfect. The Crop Reporting Service indicated the condition of wheat at from 90 to 101 in many areas in the state. Wheat grew so rapidly that the small hessian fly population generally distributed made little or no appreciable difference. R. H. Painter reported there was less than usual reduction in the stands of wheat from hessian fly, weather, or other causes since November of the previous year, which was "very unusual." By the last of May, Louis Reitz and E. T. Jones found fields with considerable hessian fly near Kingman and some near Wichita. They reported hessian fly more commonly present than was generally thought by the vigorous growth of wheat which was then heading, and the hessian fly largely were little or no hindrance to the plants. In early June, R. H. Painter reported rather heavy infestation in the northern halves of Barton, Rice, and Marion counties in certain fields. Some damage to Pawnee and Kawvale wheats was observed north of Marion near the eastern edge of the county. The severest injury was observed in a field of the variety Red Chief. A field in the northern part of Rice County showed 75 per cent infestation of Tenmarq volunteer wheat in a field of Pawnee, which showed 16 percent stems infested.

One of the greatest wheat crops ever grown in the state was harvested. The perfect growing conditions for wheat completely overshadowed the presence of hessian fly.

Reports were received in early June from several northwestern counties, especially Decatur County, that the wheat in many fields was not heading or filling properly. Hurley Fellows and E. T. Jones determined that the cause was a combination of hessian fly and green bug injury earlier. While it is believed that the larger part of the damage was probably caused by green bugs, the infestation of wheat by hessian fly was determined as follows:

County	Percent of Infestation
Cheyenne	6 to 16 percent
Sherman	6 to 68 percent
Thomas	10 percent in the volunteer
Decatur	28 percent
Norton	16 percent

The hot, dry, late summer weather was unfavorable for hessian fly and there was little hessian fly found in wheat, except in the southeastern one-fourth of the state. Most of the adults emerged after the safe planting date in the central part of the state and relatively little damage was done. Most of the adults will come out next spring over much of central Kansas, according to R. H. Painter. Near Manhattan, flaxseeds developed in wheat which was planted as late as October 11, and larvae were found on wheat planted on October 14.

Imported currant worms defoliated gooseberry and currants in the eastern third of Kansas during the latter part of April and early May. They were about as numerous as in 1946.

Leafhoppers had larger populations in 1947 than in 1946. Certain species were especially numerous and destructive to alfalfa and grapes in Kansas during 1947. The damage was augmented by the hot, dry, unfavorable growing weather during the summer. Leafhoppers were reported on **potatoes** in Doniphan, Miami, Shawnee, Neosho, and Cloud counties; on **grapes** in Riley, Doniphan, and Wyandotte counties; and in **gardens** in Woodson and McPherson counties.

Maize billbugs were seen and reported as exceptionally abundant during June in some cornfields along the river in Riley and Pottawatomie counties. This species seemed to be somewhat more plentiful than in 1946 in fields which previously had been flooded and where corn had been grown continuously for many years.

Mosquitoes were plentiful and annoying following the heavy rains of May and early June, but during the rest of the year were scarce. Most small streams and pools evaporated during August and September. Mosquitoes were reported annoying to cattle in Neosho and Reno counties.

Polistes wasps were observed as plentiful and annoying around buildings during October.

Pentatomids were reported in flight at Lyons on October 20. They swarmed about the lights and store windows in sufficient numbers to result in newspaper accounts.

Redbanded leafroller, Fascista cercerisella (Cham.), had three generations at Manhattan, each larger than the preceding. This species was more

abundant in 1947 than for several years. The last generation did severe damage to the foliage in September.

Iris borers were again very numerous on the grounds of St. Benedicts College in spite of an eradication program to eliminate them. They were neither seen nor reported in any other part of the state.

Mites of various species had smaller populations during 1947 than in 1946. The hot, dry, summer after mid-July was favorable for them and the **two-spotted mite** reached outbreak proportions in apple orchards in northeast Kansas during September. This occurence was most marked in orchards in which DDT was used for spraying. They were scarce during June and July everywhere in the state.

Chigger mites were less numerous and annoying than in 1946 during July and August in all parts of the state. They continued to be annoying in Riley County until early September.

The **European red mite** was reported from Doniphan County, but it was not authoritatively identified. The name is frequently attached to any red mites found in the state; but so far as is known, the European red mite does not occur in the state. The Pacific mite, which has been taken in the state and is also red, may be confused readily with the European red mite.

Many **arbor vitae** appeared to show mite damage, but in most cases injuries were caused by the freezing weather of January, which injury was more severe than has been noted for a generation or more.

Rose sawflies or rose slugs caused more injury in the eastern third of the state during May than has been noted for many years. Rose bushes with the foliage completely ruined were observed frequently in Riley, Clay, and Doniphan counties.

Stored grain insects attained the largest numbers during 1947 observed for many years, because so much of the crop was stored in anticipation of higher prices.

R. T. Cotton reported a large increase of stored grain insects in the wheat bins, granaries, and elevators. His statement follows:

> "Insect infestation in farm-stored wheat in Kansas has been particularly high during 1947, probably due to the fact that the moisture content of grain in storage was higher than normal and favored the more rapid increases of insect populations.
>
> "Observations made by H. H. Walkden in two counties in south-central Kansas showed that the average insect population in untreated wheat in farm storage increased from 40 insects per quart sample in July to 108 per quart of wheat in September.
>
> "If all wheat in farm storage in Kansas in September was equally infested it would mean a population of some 385 billion insects in farm bins."

Scale insects in general appeared to have increased and were more numerous than in recent years. **Forbes scale** was found in the largest numbers ever seen in the state in the region of Troy in certain orchards where DDT had been used to control codling moth for two years. This scale is held ordinarily in check by parasites. It therefore is believed that the DDT killed the parasites but not the scale. The small scale, which resembles San Jose

scale closely, was discovered by R. G. Yapp heavily clustered on twigs and around the blossom end of fruit. (See also European elm scale.)

Squash bugs were approximately equal in numbers to 1946 but little more information is at hand than is given in Table III.

Stalk borers (Papaipema) were more abundant this year than for several years.

Strawberry root worms caused severe injury to the foliage of strawberries in northeast Kansas during April and May. The injury was particularly severe in Doniphan County.

Southwestern corn borer increased in numbers during 1947 particularly in the central area of the infested portion of the state. D. A. Wilbur observed in October that fully 70 percent of all the infested stalks had been girdled and were down.

H. H. Walkden, in the fall survey, reported that "the eastern line of infestation in both Oklahoma and Kansas was found to be practically the same as in 1946. In Kansas, no infestation could be located in the fall of 1947 in certain of the counties along the eastern border of infestation in which borers were found last year, which is a line through Greenwood, Coffey, and Riley counties. The most heavily infested areas surveyed continue to be the sandy soil region of Earton, Edwards, Stafford, Rice, Reno, Pratt, and Barber counties in southcentral Kansas. Eastward from these areas, the infestation decreased rapidly. From 1940 to 1945, the corn acreage in the seven counties mentioned decreased from 100,000 to 54,000 or 46 percent. There was a still further reduction in 1947."

Tarnished plant bugs were observed to be extremely abundant in alfalfa during July and August. The **rapid plant bug** was also especially numerous and the **alfalfa plant bug** was taken in larger numbers than ever before in the history of the state. In certain fields, this species averaged one adult or nymph to each sweep of the insect net.

Termite swarms were late in appearing because of the cold, late spring but a few swarms appeared during April. During the year, termites were probably less numerous and destructive than in 1946.

Walnut worms were observed in small numbers about mid-July in Riley County. The second generation in August and September also did slight damage to a few trees. They were scarce in 1946 but slightly more plentiful in 1947.

Wheat stem maggots were more abundant in both the crop harvested in June and in the fall wheat than in 1946. Some of the hessian fly reports from the western half of the state are believed to be the based on wheat stem maggot infestation.

Wheat straw worms were reported about equal to 1946 populations, but more counties included them in their reports in 1947.

White grubs were more abundant and destructive during 1947 than in 1946. The grubs were observed to be exceptionally plentiful in gardens and lawns in Riley County during April and early May. The adults appeared about May 1 and were more numerous around lights than for several years. Their flying against screens of lighted homes from May to July was a fea-

ture of the year. The foliage of many plants was damaged by the feeding of the adults, and considerable of the grass injury during early summer is believed to have been caused by the grubs. Several species were involved in the large flights.

Cyclocephala grubs continued abundant in the western half of Kansas and caused damage to some 50,000 acres of fall sown wheat in central and northwest counties. Growers, however, delayed sowing of their wheat because of inadequate moisture; otherwise the damage from this species might have been extensive. The increase in this species is believed to be due to plowing under so much wheat straw.

Wireworms were more plentiful in 1947 than in 1946 and were reported from more counties also.

SUMMARY AND CONCLUSIONS

Corn and other spring seeded crops had a late start on account of the cool, wet weather during the spring and were badly damaged in a severe drouth and hot spell that began the latter part of July and continued through September. August was the hottest in 10 years and the driest in 11 years. Record-breaking or near record-breaking hot weather continued through September, with rainfall deficient. Pastures dried up and corn suffered further damage. October was the warmest on record and below normal in precipitation, which resulted in an unfavorable condition for seeding wheat. November, however, was cool and cloudy, with frequent light rains, and December falls of moisture totaled heavier than any since June.

The wheat crop was one of the largest ever harvested in the state. The largest acreage was devoted to wheat and the highest average bushel yield per acre was harvested. The oats, barley, alfalfa and other hay, alfalfa seed, and apple crops were well above the ten year averages. Corn, potatoes, sorghums, soybeans, and honey production was well below that of the recent several years.

It was a year of increased populations of many species of insects and of some outbreaks. The following insects and related forms occurred in **outbreak** numbers or were as numerous as they have been in previous years of high abundance: armyworms, including the wheat head armyworm locally in eastern Kansas; cicadas, both the seventeen-year and two-year species in eastern Kansas; false wireworms in western Kansas; horse flies; garden webworms; maize billbug; stored grain insects in wheat; and the cyclocephala white grub in west-central Kansas.

The following species in addition to those listed under outbreak were **more numerous** in 1947 than in 1946: pea aphids, green bug, black flies, borers in shade and fruit trees, boxelder bugs, carpet beetles, clover seed chalcid, clover stem borer, Colorado potato beetle, corn earworms, corn rootworms, corn sap beetles, European cornborer, tree crickets, cutworms, fall armyworms, fall webworms, leafhoppers, mosquitoes (early summer),

polistes wasps, red-banded leafroller, rose sawfly, scale insects especially Forbes scale, southwestern cornborer, tomato hornworms, plant bugs, walnut worms, wheat stem maggots, and white grubs.

The following species were as **plentiful** in 1947 as in 1946: ants, blister beetles, cankerworms, codling moths, columbine leaf miner, crickets, cucumber beetles, cutworms, mites—two-spotted and chigger mites in northeast Kansas, squash bugs, tent caterpillars, and wheat strawworms.

The following species were **less plentiful** in 1947 than in 1946: aphids on apple, snowball, chrysanthemum, and spiraea; bagworms, bot flies, bean leaf beetles, cabbage worms, cattle grubs, elm Calligrapha, fleas in homes; flies including horn, stable, house, and screwworm flies, grasshoppers, hackberry psyllids, hessian fly (except southcentral Kansas), mosquitoes (late summer and fall), mites, termites, tomato hornworms, and millipedes.

The following species **were scarce** or had extremely low populations in 1947: elm seed wing midge, chinch bugs, and green striped maple worms.

NOTE ON EMBIOPTERA IN KANSAS

During the present winter, Robert Kitchen, a student in General Entomology at Fort Hays Kansas State College, has collected three winged Embiids in his basement apartment in Hays, Kansas. The three collection dates were, December 13, December 17, and January 17, and all specimens were found on the floor or walls of the apartment. The colony has not been found but crevices in the concrete floor near the furnace offer the best possibility for breeding places.

A specimen was sent to Doctor Edward S. Ross, Curator of Insects at the California Academy of Sciences, who identified it as **Oligotoma saundersii** (Westwood). This species is apparently distributed throughout the warmer regions of the world.

Prior to March, 1944, a dealer in oil well supplies owned the house and made frequent business trips by plane to Texas. From March, 1944, to August, 1945, the families of three airplane pilots lived in the apartment at various times and brought various items from points in Texas, Florida, Cuba, Mexico, and Panama. So far as known, there is no way by which the insects could have been introduced into the apartment since August, 1945, as occupants since that time have not made trips to the southern part of the United States or other places where these insects are normally found.

LEON HEPNER,
Hays, Kansas.

HOMONYMY NOTES IN THE BIBIONIDAE

D. ELMO HARDY
Ames, Iowa

While preparing a check list of the world Bibionidae, the writer has found that quite a number of the names now in use are preoccupied and need to be changed.

Penthetria brunettii, new name for **Penthetria atra** (Brunetti), 1911, Rec. Ind. Mus., 4:272. Preoccupied by **Penthetria atra** Macquart, 1834, Hist. Nat. Ins., 1:175. Brunetti's **atra** was described in the genus **Precia** but it is a typical **Penthetria** and has been changed to this genus.

Plecia malayaensis, new name for **Plecia minor** Edwards, 1928, Journ. Fed. Mal. States Mus., 14:44. Preoccupied by **Plecia minor** Jaennicks, 1867, Abhandl. Senckenb. naturf. Gesellsch., 4:318.

Plecia mallochi, new name for **Plecia confusa** Malloch, 1928, Proc. Linn. Soc. New S. Wales, 53:605. Preoccupied by **Plecia confusa** Loew, 1858, Berl. Ento. Zeits., 2:109.

Philia beckeri, new name for **Philia minor** (Becker), (**Dilophus**), 1908, Mitt. Zool. Mus. Berl., 4:60. Preoccupied by **Philia minor** (Strobl), (**Dilophus**), 1900, Wien. Ent. Zeitg., 19:92.

Philia edwardsi, new name for **Philia minor** (Edwards), **Dilophus,** 1938, Ann. Mag. Nat. His. (11)2:330. Preoccupied by **Philia minor** (Strobl).

Philia brazilensis, new name for **Philia occipitalis** (Edwards), (**Dilophus**), 1935, Stylops, 4:21. Preoccupied by **Philia occipitalis** (Coquillett), 1904, Invert. Pac., 1:20.

Philia peruensis, new name for **Philia clavipes** (Edwards), (**Dilophus**), 1935, Stylops, 4:24. Preoccupied by **Philia clavipes** (Lundström), (**Dilophus**). This was apparently just a cabinet name of Lundström's in the Hungarian National Museum. Duda published it as a synonym of **P. ingens** (Loew) in 1930, Die Flieg. der Pal. Reg., 2(4):33.

PRICE OF BACK VOLUMES

Back Volumes $2.50 per volume

Subscriptions for back volumes or numbers should be sent to Donald A. Wilbur, Department of Entomology, Kansas State College, Manhattan, Kansas.

CONTENTS OF THIS NUMBER

Some New Species of Delphacodes (Continued) (Homoptera, Fulgoridae, Delphacinae).
R. H. BEAMER 1

Notes of the Beet Leafhopper, **Circulifer tenellus** (Baker), and Its Relatives (Homoptera: Cicadellidae)
P. W. OMAN 10

The Seventeenth or 1947 Annual Insect Population Summary of Kansas. ROGER C. SMITH and GEORGE A. DEAN 15

Note on Embioptera in Kansas.
LEON W. HEPNER 35

Homonymy Notes in the Bibionidae.
D. ELMO HARDY 36

1
10
15
35
36